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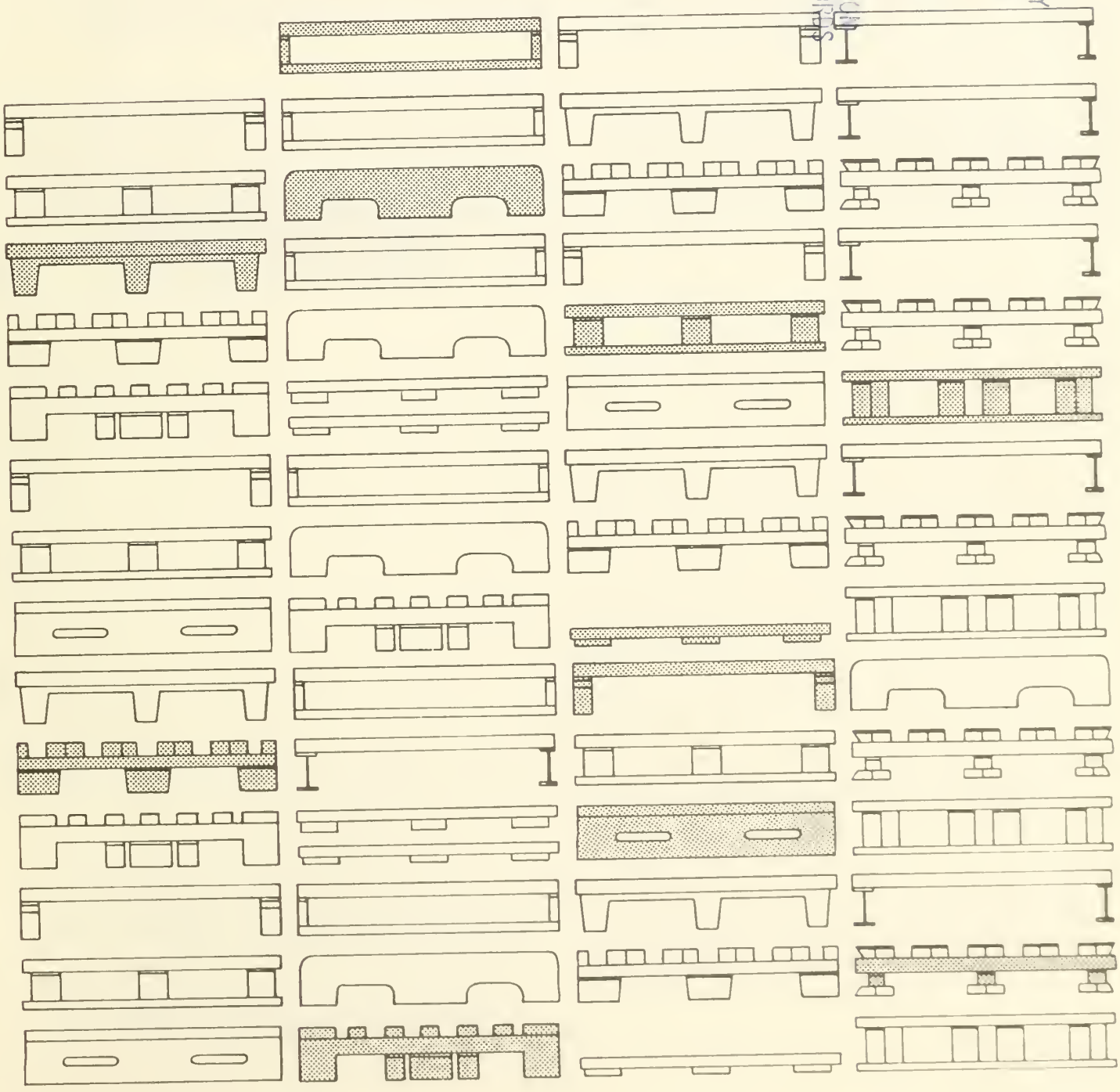
An Evaluation of Various Types of Permanent Pallets



Preface

This publication reports on a broad research program by the Market Research and Development Division, Agricultural Marketing Service, U.S. Department of Agriculture, on marketing systems for fresh fruits, vegetables, and frozen foods.

The research was done at the Beltsville Agricultural Research Center, Beltsville, Md., and in commercial plants at Exmore, Va., and Edmonston, Md., with the cooperation of the firms and plant managers of Exmore Foods, Inc., Exmore, Va. and Good Humor Ice Cream Co., Edmonston, Md.

Company names are used in this publication only to provide specific information. Mention of the company name does not constitute an endorsement by the U.S. Department of Agriculture over other companies not mentioned.

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Abstract

Twelve types of aluminum, plastic, and wooden permanent pallets were evaluated for possible use in handling systems for fresh and frozen food items. The pallets were subjected to the following physical tests: (1) aging—placed in commercial use for one full year, (2) dropping—performed random corner drops onto a concrete surface, (3) racking—2,000-pound load for 24 hours on a rack, and (4) stacking—2,200-pound load for 72 hours on a concrete slab. Costs and opinions of the commercial cooperators were included in the final evaluations of these pallets.

The standard hardwood pallet, presently found in commercial use, the molded plastic solid deck, and the molded plastic heavy grid satisfactorily passed the four physical tests. The costs of the two latter pallets were about 4.7 and 3.5 times more expensive than the standard hardwood pallet. No pallet that could be sanitized and that was not prohibitively high in cost was strong enough to replace the standard hardwood pallet.

An Evaluation of Various Types of Permanent Pallets

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This report evaluates the potential of various permanent 48- by 40-inch pallets for use in unitized systems for handling fresh fruits, vegetables, and frozen foods. These pallets were constructed from a number of materials, such as wood, plastic, and aluminum.

Virtually all internal handling of food products utilizes pallets of some form including unit loads. This presents a vast area of potential interest in different types of pallets other than the standard hardwood pallet. This report provides the pallet-user with information and an evaluation of a variety of permanent pallets available.

Wooden pallets were first introduced into industry in the late 1930's. The wooden pallet industry has grown from almost nothing before World War II to a half-billion-dollar per-year industry. World War II created a need for materials-handling platforms and was mostly responsible for the industry's development. Between 1940 and 1945, the Department of Defense used 55 to 60 million pallets.[2]

After the war, the pallet's use expanded, and some experts considered the pallet to be one of the most important devices in the whole range of materials handling equipment. More than 15 percent of our Nation's hardwood lumber is consumed by this industry.

The idea of unitized (palletized) handling[3] was born when only wooden pallets were used. Other materials, such as steel, aluminum, fiberboard, and plastics, were introduced to build pallets for specific uses.

Sanitation standards may be imposed on the food industry sometime in the foreseeable future. This may eliminate the use of wooden pallets and require pallets made from materials that can be effectively cleaned and sanitized. In the future, permanent pallets that are constructed of aluminum and plastic and are presently available most likely will be used.

Previous research has evaluated disposable pallets for use in unitized handling and shipping systems. Eleven pallets were evaluated and only the fiberboard slip-sheet was rated as acceptable for use from both a physical and cost standpoint.[4]

Twelve types of wooden, aluminum, and plastic pallets were evaluated. Undoubtedly other permanent pallets were available in the United States, but the 12 that were evaluated were the only ones available to the researchers at the time of this study.

[1]Coauthors listed alphabetically

[2]Lucas, John T. and Walter B. Wallin, The Department of Defense Market for Wooden Pallets: 1965, USFA Res. Paper NE-117, 1968, p. 2.

[3]Bolz, Harold F. N Materials Handling Handbook, The Ronald Press Company, 1958, p. 17.1

[4]Anthony, Joseph P., Jr. and Robert C. Mongelli An Evaluation of Various Types of Disposable Pallets in Unitized Systems for Fresh Citrus Fruits. ARS-NE-75, October 1978.

Procedure

The permanent pallets studied were evaluated after the results of four basic physical tests and individual costs were compared. These comparisons, along with the opinions of the researchers and cooperators, constituted the evaluations.

The first of the physical tests was to "age" all of the pallets for 1 full year in actual food industry use (fig. 1). Researchers felt that this was one of the more practicable and inclusive methods of stressing the pallets prior to subsequent laboratory testing. One frozen food plant and one ice cream plant were chosen because they afforded year-round inplant handling, over-the-road transport and handling, and great fluctuations in temperature including long periods below freezing. This particular combination of stressors was not available at any other type of food handling facilities.

After recovery from the food industry systems, all of the "aged" pallets were then put through a series of eight random corner drops (fig. 2) 4 feet onto a concrete slab. The effects of the drops were observed and recorded.

The "aged and dropped" pallets were then subjected to a rack storage test (fig. 3). Each pallet was supported by only the outside 2 inches of the bottom (to simulate storage in a pallet rack) and a 2,000-pound load was stacked on the pallet. Each loaded pallet was held for 24 hours. The average amount of pallet deflection at the front and rear midlines was recorded after loading, after 24 hours, and again after unloading. A deflection of 2 inches or more in this test was considered excessive and could lead to load shifting and potential product damage in commercial use.

Figure 2.—Pallets were dropped on a corner from a height of 4 feet, and damage observed and recorded.

Figure 1.—Pallets being unloaded at the commercial plant before being placed into industrial use for a year. This picture also shows the diversity among the pallets evaluated.

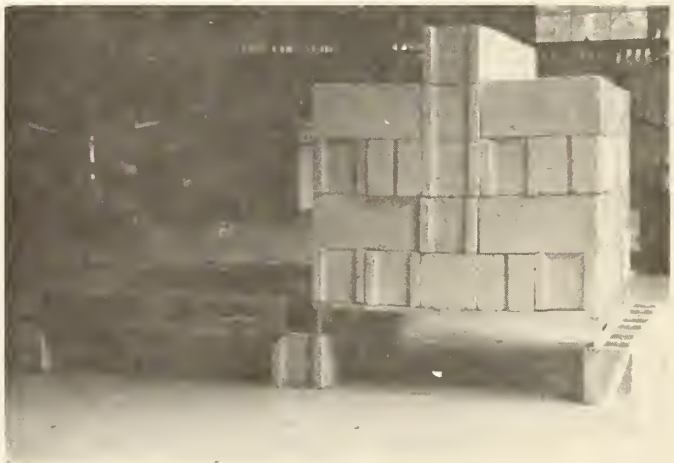


Figure 3.—Supported by the outside 2 inches to simulate storage in a pallet rack, pallets were loaded with 2,000 pounds and deflection measured.

Figure 4.—Sitting on a concrete slab, the pallets were loaded with 2,200 pounds for 72 hours and deflection measured.

Figure 5.—Pallet A, hardwood standard: *A*, top view and *B*, bottom view.

The final physical test consisted of placing the pallets on a concrete slab and stacking a 2,200-pound load on each pallet (fig. 4) for 72 hours. Pallet changes were recorded, and average front and rear midline measurements were taken before, during, and after this procedure. A deflection of one-half inch or less was a standard for acceptance; a larger deflection raised doubts about the structural strength of the deck.

Manufacturers supplied purchase prices of each pallet for comparison. Where actual prices were unavailable, estimates were used.

Pallet A: Hardwood standard

This 48- by 40- by 5-3/16-inch pallet was constructed of hardwood (fig. 5 *A* and *B*). Seven deck boards were nailed to three notched runners and five bottom boards were nailed with the notches free to provide four-way handling capabilities. These pallets weighed an average of 61 pounds. This was a dry weight, but once the pallets were exposed to the moisture-laden environment present in the food industry, weights in excess of 80 pounds were quite common.

The wooden pallets that were entered into the aging process were never recovered, and although they are still in use, are lost in the cooperator's system. Using "unaged" pallets, corner drop testing produced no visible damage. The rack storage test produced an average pallet deflection of 0.3125-inch upon loading with 2,000 pounds, 0.3125-inch after 24 hours, and 0.0625-inch after unloading. The floorloading tests using 2,200 pounds revealed no measurable deck deflection at any of the three measurement intervals (upon loading, after 72 hours, and after unloading). Costs for wooden pallets vary, but at the time of this study, were about $7.50 in truckload quantities of more than 400 pallets.

At present, these pallets are the materials-handling backbone of the food industry, so they definitely fulfill the hypothetical requirements of this study. Their shortcoming is their inability to be adequately sanitized.

Pallet B: Molded Plastic Solid Deck
This 48- by 40- by 5-inch pallet was constructed of molded structural foam (fig. 6 *A* and *B*). The four-way entry pallets weighed an average of 46 pounds, 12 ounces as compared to an advertised weight of 45 pounds.

Corner drops produced no damage. Rack storage testing yielded an average pallet deflection of 0.7188-inch immediately upon loading with 2,000 pounds, 0.7500-inch after 24 hours, and 0.3750-inch immediately after unloading. This proved to be merely a flexing, and no permanent pallet deflection resulted. Floorloading revealed no deck deflection at any of the three measurement intervals (upon loading, after 72 hours, and after unloading). This pallet costs $39.85 in quantities of 1 to 26, $37.95 in quantities of 27 to 500, and $35.00 in quantities of 501 and up.

These pallets should definitely be strong enough to do the job in any food handling operation. Because of the one-piece construction and the durability of structural foam, repairs could be minimal when compared to wooden pallets. Used pallets could be traded in for replacement pallets, since structural foam can be reprocessed and used again. A main stumbling block would be cost. At $35 per pallet, it is 4.7 times the price of a standard hardwood pallet.

Figure 6.—Pallet B, molded plastic solid deck; *A*, top view and *B*, bottom view.

Pallet C: Molded Plastic Light Grid
This 48- by 40- by 4¾-inch pallet (fig. 7 *A* and *B*) was molded from high-density polyethylene expanded plastic (structural foam). This pallet had partial four-way entry (four-way entry for forklift truck tines and two-way entry for pallet jack forks). This nonreversible flush deck pallet weighed an average of 29 pounds, 7 ounces as compared to an advertised weight of 28 pounds.

After the pallet was aged, the cooperators complained that it sagged when fully loaded. The rack storage test resulted in a pallet deflection of 0.6094-inch upon loading, 0.6406-inch after 24 hours, and 0.4063-inch after unloading. This final deck flexing was corrected by the pallet's own weight within 12 hours. The floorloaded test had a deck deflection of 0.0156-inch upon loading, 0.0156-inch after 72 hours, and 0.0156-inch after unloading. Although this pallet sagged during the testing, it did not sag as much as some of the other pallets, but gave an impression of sagging more. There appeared to be no noticeable structural damage from the aging

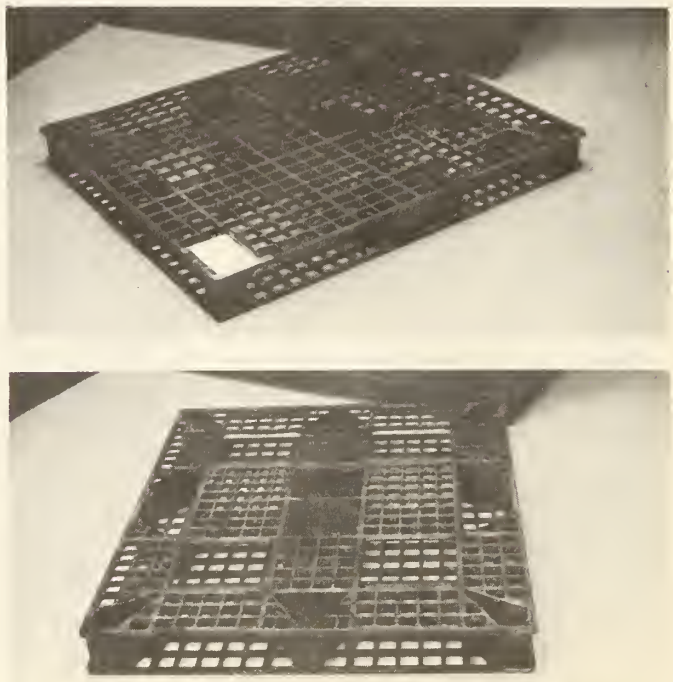


Figure 7.—Pallet C, molded plastic light grid: *A*, top view and *B*, bottom view.

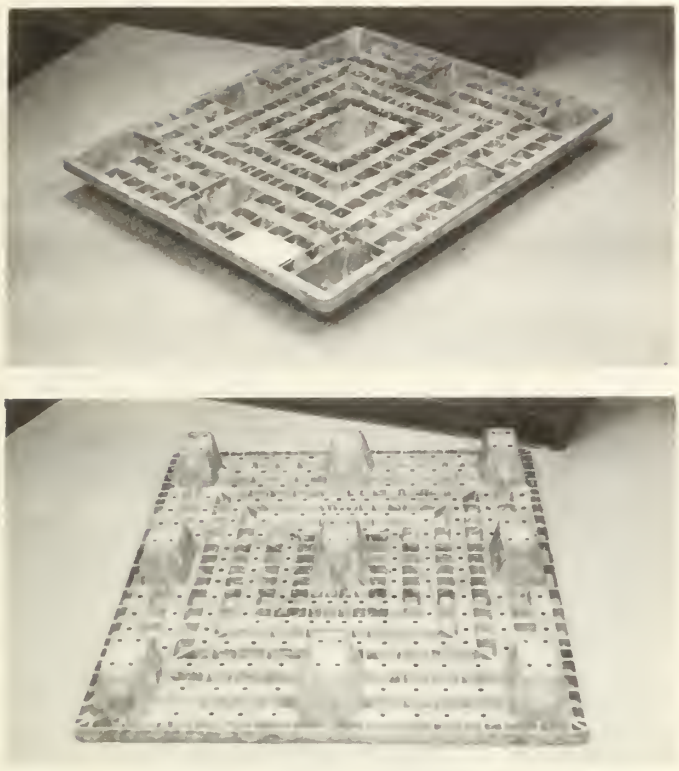


Figure 8.—Pallet D, molded plastic single face: *A*, top view and *B*, bottom view.

process. The corner drop test resulted in no damage. In less-than-truckload (LTL) orders, the cost for this pallet is $19.75 and in orders of 400 and up (truckload) the cost is $18.25.

During the testing, both researchers and cooperators questioned the pallet's strength. Cooperators complained about this pallet's pliability when fully loaded and handled. The cost of repairs is unknown. The cost at $18.25 per pallet was about 2.4 times the price of a hardwood pallet. This pallet may prove acceptable, but because of its light construction, its sister pallet, Pallet G, would be recommended as a substitute.

Pallet D: Molded Plastic Single Face

This 48- by 40- by 5-inch pallet (fig. 8 *A* and *B*) was molded from an "extra-high-impact polystyrene." This four-way entry pallet has a pattern of "trapezoidal corrugations with transverse cross-ribs" molded into the deck. This nonreversible and nestable pallet was made with numerous drain holes molded into the deck which could make sanitizing easier.

Close inspection after recovery from the aging process revealed that small pieces of the deck were broken off during routine inplant handling procedures, although no damage was discovered after the corner drop tests. The rack storage test resulted in a pallet deflection of 1.0625-inches upon loading, 1.4370-inches after 24 hours, and 0.1250-inch after unloading. This pallet displayed the greatest range of flexibility of any of the pallets put through this test. The floor-loaded testing produced no measurable deck deflection at any of the three measurement intervals, upon loading, after 72 hours, and after unloading. For orders of two the cost of this pallet is $17.50 each; for 3 to 50, $16.80; for 51 to 200, $16.50; for 201-400, $16.20; for 401—truckload, $16.00; and for truckloads, $15.80.

Cooperators were concerned with repairs and expressed interest in trade-ins and recyclability. Double and triple stacking of pallet loads could cause damage to produce loads, since the weight of these pallet loads is concentrated on the nine legs and transferred to the top layer of the bottom pallet load. The cost of this pallet at $15.80 is about two times the cost of a hardwood pallet. The damage that the decks of these pallets suffered during aging makes the use of this pallet questionable.

Pallet E: Molded Plastic Double Face
This 48- by 40- by 5¾-inch pallet (fig. 9 *A* and *B*) was molded from an "extra-high-impact" polystyrene, which is advertised to be without undesirable flexibility. This four-way entry pallet has a pattern of "trapezoidal corrugations with transverse cross-ribs" molded into the deck. This nonreversible (for most food-industry requirements) pallet weighed an average of 44 pounds as compared to an advertised weight of 40 pounds.

One of the cooperators who participated in the aging was impressed and commented favorably about this pallet. The other cooperator returned these pallets with broken decks and corners (fig..10 and 11), and could give no explanation as to cause, so the aging process brought mixed results. The rack storage test resulted in a pallet deflection of 0.2813-inch upon loading, 0.2813-inch after 24 hours, and 0.0000-inch after unloading. The floorloaded test had a deck deflection of 0.1250-inch upon loading, 0.1250-inch after 72 hours, and 0.125-inch after unloading. This deck flexing was corrected within a few hours. For orders of two, the cost of this pallet is $25 each; for 3 to 50, $24.90; for 51 to 200, $24.60; for 201 to 400, $24.30; for 401 to a truckload, $24.05; and for truckloads, $23.80.

As with the other plastic pallets the questions of repairs, recycling, and trade-ins were raised. Recycling and trade-ins would be closely related and might pose few problems, but practicality is another matter and should be investigated. The cost of this pallet at $23.80 was almost 3.2 times the cost of a hardwood pallet. The damage to the decks and corners of some of these pallets during aging tests raise serious doubts as to these pallets' longevity.

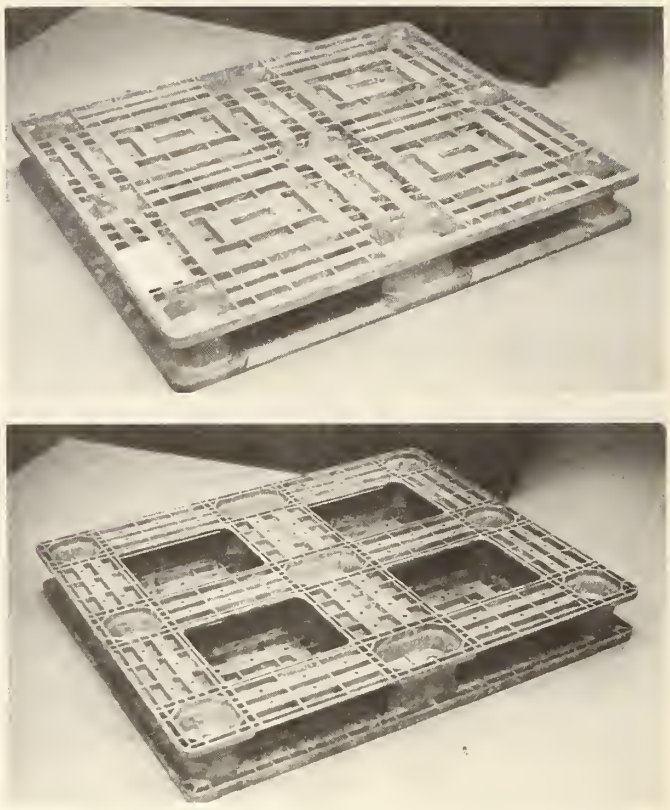
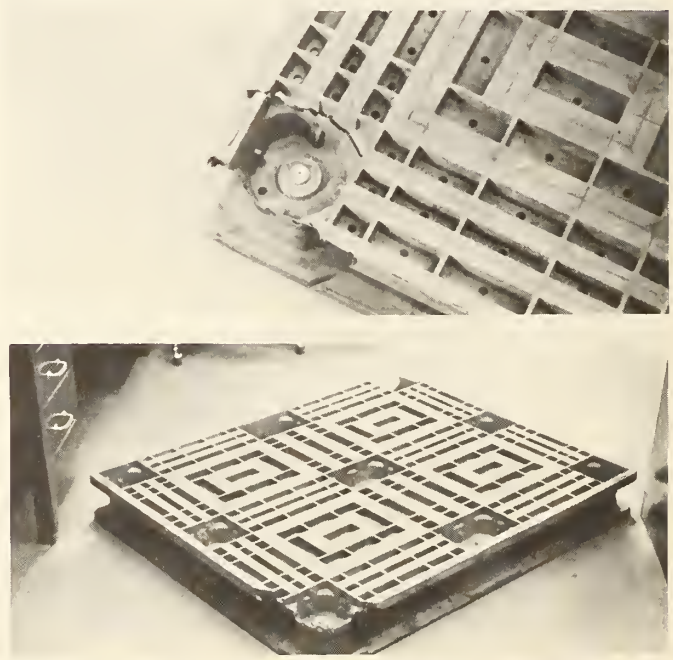


Figure 9.—Pallet E, molded plastic double face: *A*, top view and *B*, bottom view.



Figures 10 and 11.—Corner and deck damage to Pallet E, molded plastic double face.

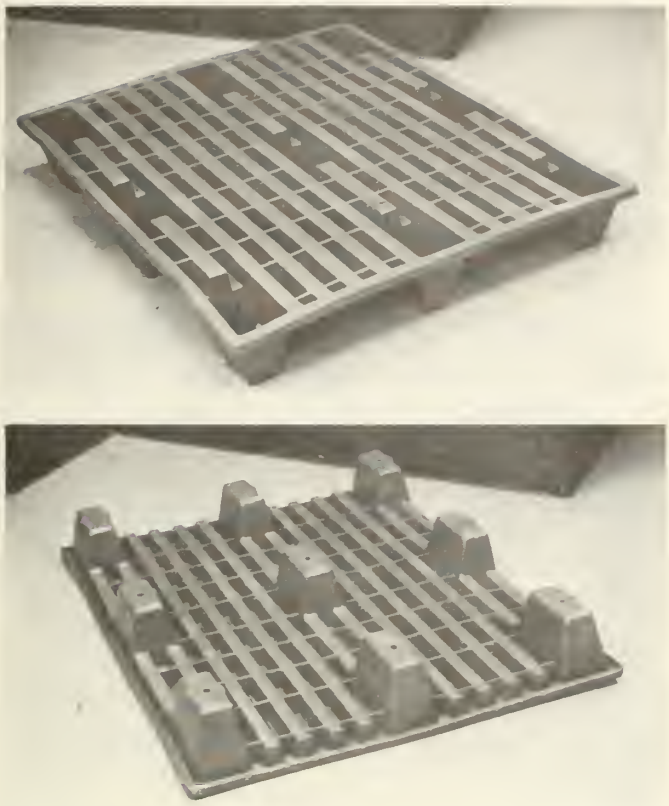


Figure 12.—Pallet F, molded plastic nine-leg: *A*, top view and *B*, bottom view.

Figure 13.—Crack in deck and warp of pallet show up in rack storage test of Pallet F.

Pallet F: Molded Plastic Nine-Leg

This 48- by 40- by 6¼-inch pallet (fig. 12 *A* and *B*) was molded of "high-density" polyethelene. This four-way entry pallet has a specially designed deck to reduce flexing and increase strength. This nonreversible pallet weighed an average of 43 pounds, 8 ounces as compared to an advertised weight of 48 pounds.

When the pallets were recovered after aging, all had developed cracks in the deck, usually at the corners and edges (fig. 13). The decks of all of these pallets warped. This seemed to have no effect on performance in any of the testing, but it did affect the nestability when placed in empty storage or transport. The drop test caused some corner damage to this pallet. The rack storage test resulted in a pallet deflection of 0.6563-inch upon loading, 0.6875-inch after 24 hours, and 0.4375-inch after unloading. The floorloading test had a deck deflection of 0.2188-inch upon loading, 0.2500-inch after 72 hours, and 0.1563-inch after unloading. This pallet costs $30.20 for orders of 1 to 10, $29.15 for orders of 11 to 999, and $28.60 for orders of 1000 and more.

The cracks that developed in the decks, the corner damage that resulted from drop testing, and the warping of the deck after aging raise doubts as to the suitability of this pallet for use in the fresh and frozen food field. The cost of this pallet at $28.60 is more than 3.8 times the cost of a hardwood pallet.

Pallet G: Molded Plastic Heavy Grid
This 48- by 40- by 5-1/8-inch pallet (fig. 14 *A* and *B*) was molded from high-density polyethylene. This four-way entry pallet has tapered entries on all four sides which improve forklift truck handling ease and efficiency. This nonreversible pallet weighed 44 pounds, its advertised weight.

Neither the aging procedure nor the corner drop testing produced any visible structural damage. The rack storage test yielded a pallet deflection of 0.2188-inch upon loading, 0.3750-inch after 24 hours, and 0.1875-inch after unloading. The floorloaded testing resulted in no measurable deck deflection at any of the three measuring intervals (upon loading, after 72 hours, and after unloading). This pallet cost $27.50 for orders of LTL quantities and $26.00 for truckload quantities (400 or more).

This pallet drew very favorable responses from cooperators, but as with all of the other plastic pallets, questions centered around repairs and possible trade-ins. After a year of aging and testing, these particular pallets showed no signs of wear or abuse. The cost of this pallet at $26 is about 3.5 times the cost of a wooden pallet. This pallet should be fully acceptable, cost considerations aside, for use in the food industry.

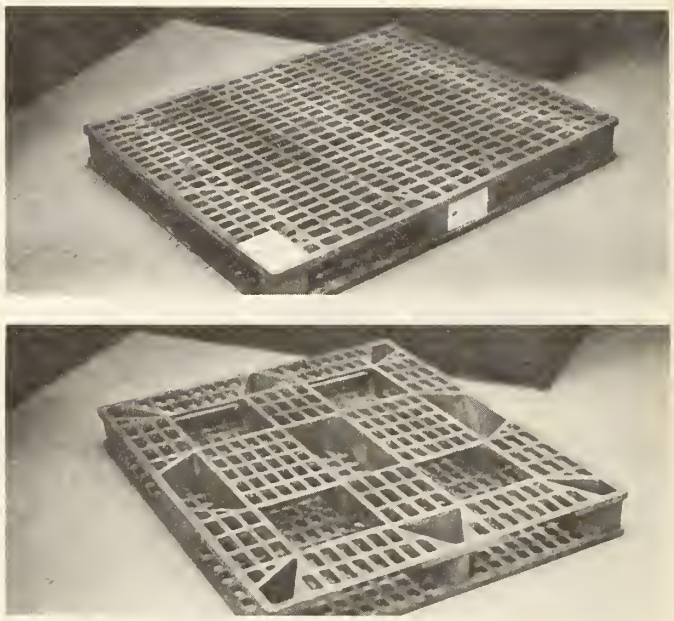


Figure 14.—Pallet G, molded plastic heavy grid: *A*, top view and *B*, bottom view.

Pallet H: Molded Plastic Foam Filled
This 48- by 40- by 5¼-inch, 3-runner pallet (fig. 15 *A* and *B*) was made of high-density polyethelene cross-link skin filled with a polyurethane foam. This pallet was designed for the meat and food industry and the pallets tested did not have the optional steel reinforcing that is available. This nonreversible pallet weighed an average of 32 pounds, 4 ounces as compared to an advertised weight of 35 pounds.

Upon recovery after the aging procedure there was no visible structural damage, but the decks had warped. The drop test produced slight corner damage. The rack storage test resulted in a pallet deflection of 0.6563-inch upon loading, 0.6563-inch after 24 hours, and 0.2500-inch after unloading. The floorloaded test produced a deck deflection of 0.0625-inch upon loading, 0.0625-inch after 72 hours, and 0.0625-inch after unloading. The cost of this pallet is $30.85, in any order size, and the manufacturer pays part of the freight charges in truckload orders over 500 pallets.

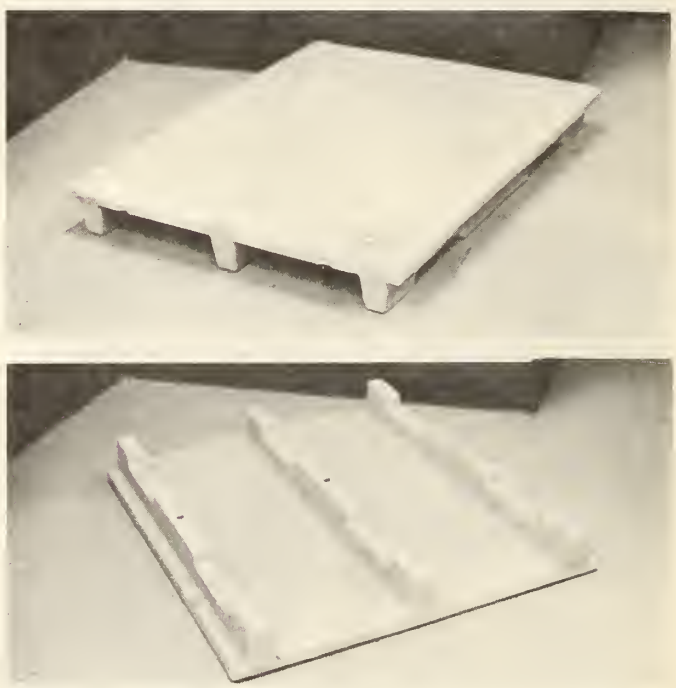


Figure 15.—Pallet H, molded plastic foam filled: *A*, top view and *B*, bottom view.

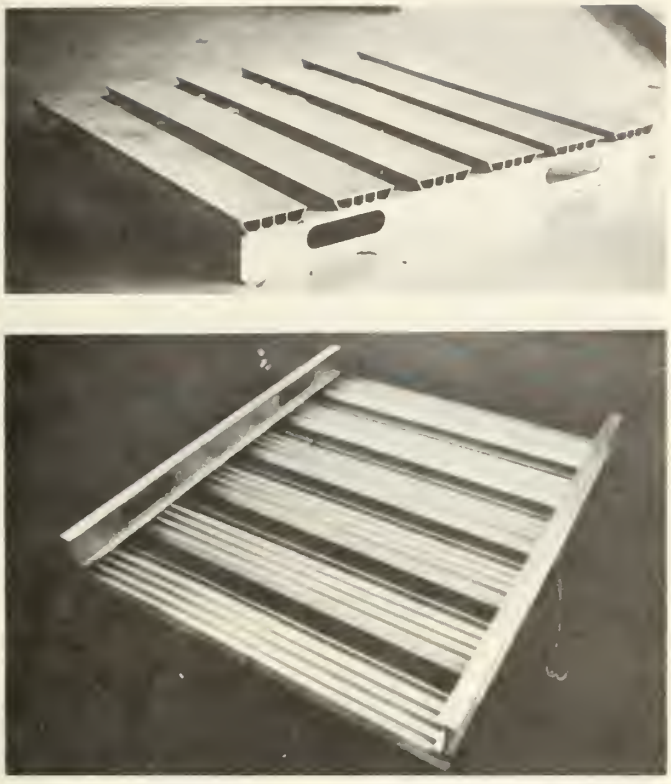


Figure 16.—Pallet I, aluminum I-beam: *A*, top view and *B*, bottom view.

Figure 17.—Bent leading edge of deck board of Pallet I. Damage occurred during the aging procedure.

Cooperators commented that the deck of this pallet was slippery when wet and hampered operations. The corner damage and deck warping, along with probable difficulties for repairs and recycling, raise doubts about the use of this pallet. The cost at $30.85 is about 4.1 times that of a hardwood pallet.

Pallet I: Aluminum I-beam

This 48- by 40- by 5-inch pallet (fig. 16 *A* and *B*) was constructed of two "beams" that also serve as runners, and six 1- by 6-inch slats welded to them. The runners had slots that gave the pallet four-way capabilities. This nonreversible pallet weighed an average of 34 pounds, 6 ounces.

During the aging procedure one of the leading deckboards was bent (fig. 17). It could not be determined if this was caused by excessive weight or abuse. Corners were bent during drop testing and could cause damage to boxes they might contact during handling. These corners can easily be repaired with a hammer. The rack storage test resulted in a pallet deflection of 0.1250-inch upon loading, 0.1250-inch after 24 hours, and no deflection after unloading. The floor loaded testing produced a deck deflection of 0.1875-inch upon loading. 0.2813-inch after 72 hours, and no deflection after unloading. This pallet costs $120 each in orders of 50.

The cooperators' feelings on this pallet were initially quite favorable, but they were not so impressed with this pallet after aging. Inplant repairs could be easily implemented. Corner damage could still pose a problem, but this could be remedied with little difficulty. The cost of this pallet at $120 was about 16 times the cost of a hardwood pallet.

Pallet J: Aluminum Block Leg
This 48- by 40- by 7-inch pallet (fig. 18 *A* and *B*) was constructed of two runners, six blocks and six slats welded to form a four-way entry nonreversible pallet. This design was purely experimental and was created by the manufacturer to be included in this research. This pallet weighed an average of 41 pounds, 8 ounces.

During the aging procedure one of the block legs was cut by a forklift truck (fig. 19). The damage was minor but did point out potential product damage causes. Other than damage to the leg, the pallet showed no damage from aging. The drop test caused damage to the corners which could be potential carton gougers, and bent one of the block legs inward (fig. 20). Also the weld between the deck slat and the runner broke during the drop test. The rack storage test resulted in a pallet deflection of 0.1250-inch upon loading, 0.1250-inch after 24 hours, and 0.0625-inch after unloading. The floor-loaded testing produced a deck deflection of 0.1250-inch upon loading, 0.1563-inch after 72 hours, and no deflection after unloading. Because this pallet was experimental, there is no established market price, but it would probably cost at least $100.

The cooperator's early enthusiasm soon cooled because of bent corners and slippery decks when wet. The results of drop tests and the aging procedure make this pallet doubtful for a food industry system. The $100 cost is about 13.3 times the cost of a hardwood pallet.

Pallet K: Aluminum Two-way Tube
This 48- by 40- by 6-inch pallet (fig. 21 *A* and *B*) was constructed of two "tubes" which serve as runners, six top deck slats, and three bottom slats welded together to form a two-way entry nonreversible pallet. As with pallet I, this pallet was experimental. It weighed an average of 49 pounds.

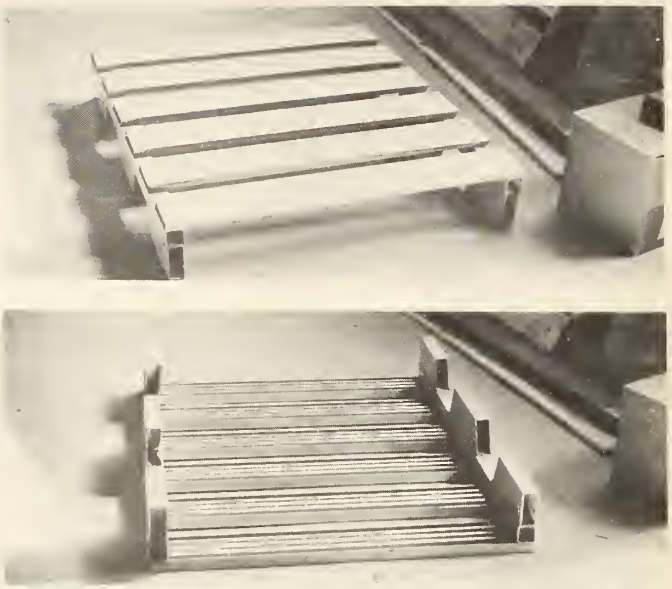


Figure 18.—Pallet J; aluminum block leg: *A*, top view and *B*, bottom view.

Figure 19.—One of the block legs of Pallet J was hit and cut by a forklift truck.

Figure 20.—Corner damage to a leg incurred during drop test.

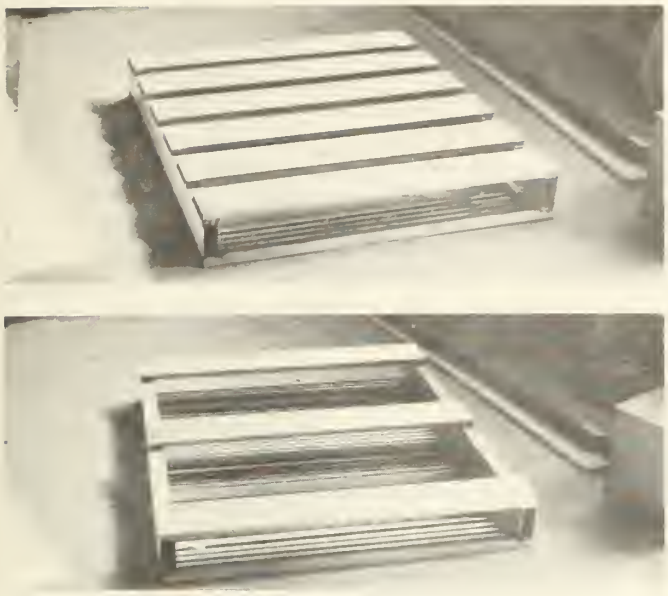


Figure 21.—Pallet K, aluminum two-way tube: *A*, top view and *B*, bottom view.

Figure 22.—Broken weld where center slot was attached to runner.

Figure 23.—Corner damage from drop test could cause damage to carton.

Upon recovery after the aging procedure the pallets showed no signs of damage other than a broken weld where the center bottom slat was attached to the runner (fig. 22). The drop test produced damaged corners (fig. 23), like the other aluminum pallets. These bent corners could cause carton damage. The rack storage test resulted in a pallet deflection of 0.2813-inch upon loading, 0.3488-inch after 24 hours, and 0.1250-inch after unloading. The floorloaded testing yielded a deck deflection of 0.2813-inch after loading, 0.2813-inch after 72 hours, and 0.1250-inch after unloading. While this pallet was experimental, it was similar to a pallet already marketed, and should have an estimated market value of about $120.

Cooperators' reactions to this pallet were initial interest and final disinterest. The results of the drop test coupled with the costs of these pallets raise doubts about their use in the food industry. The $120 cost is about 16 times the cost of a hardwood pallet.

This pallet did not perform very well during the aging procedure and was not liked by the cooperators. Corner damage plus pallet damage and the cost make the use of this pallet unlikely in the food industry. The cost at $76.65 was about 10.2 times the cost of a hardwood pallet.

Pallet L: Aluminum Four-way

This 48- by 40- by 5½-inch pallet (fig. 24 *A* and *B*) was constructed of I-beam runners, block spacers, bottom slats and deck slats welded together to make a four-way entry, nonreversible pallet. This pallet had an average weight of 47 pounds, 6 ounces.

Upon recovery from the aging procedure, these pallets displayed effects of their exposure, dented bottom slats, bent deck slats, and damaged corners (fig. 25). The drop tests produced the usual corner damage (fig. 26) found with all the aluminum pallets. The rack storage test resulted in a pallet deflection of 0.0625-inch after loading, 0.0625-inch after 24 hours, and 0.0313-inch after unloading. The floorloaded test produced no measurable deck deflection during the 72 hours of testing. This pallet costs $81.48 in orders of 1 to 100, $78.46 in orders of 500, and $76.65 in orders of 1,000.

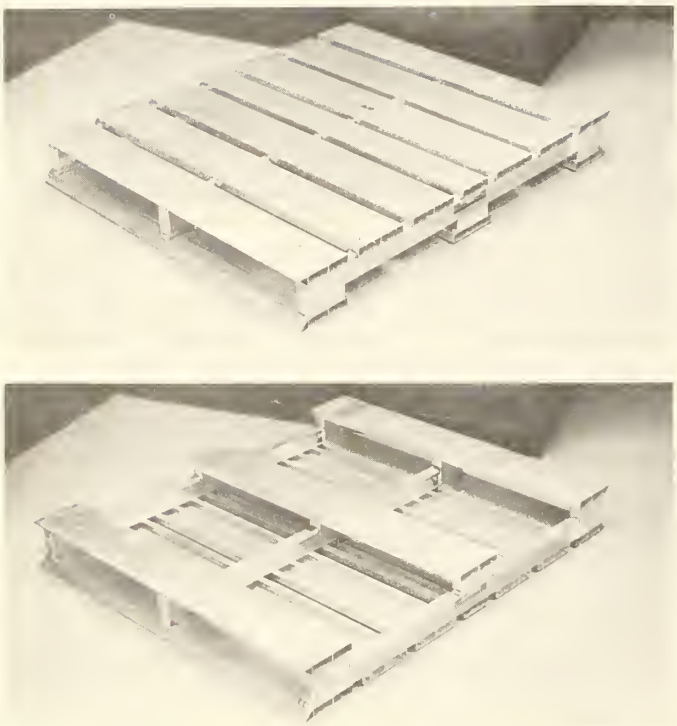


Figure 24.—Pallet L, aluminum four-way: *A*, top view and *B*, bottom view.

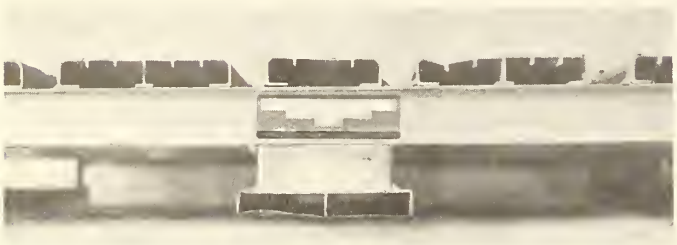


Figure 25.—Damage to Pallet L from use in a food handling facility.

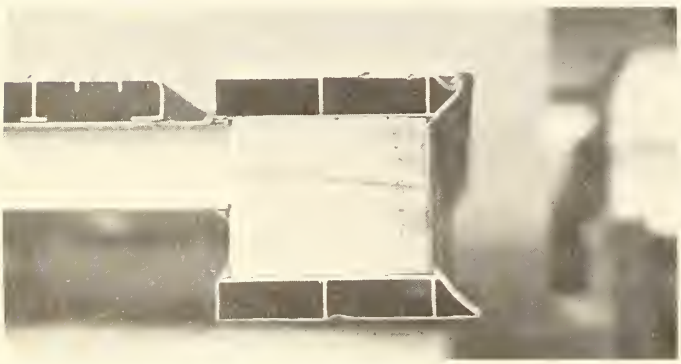


Figure 26.—Corner damage from drop test.

Table 1 contains basic information on all of the types of permanent pallets evaluated. Twelve different types were tested. Prices ranged from a low of $7.50 for Pallet A, hardwood standard, to a high of $120 for Pallet I, aluminum I-beam. All of the pallets were 48 by 40 inches and varied only in height, which ranged from 4¾ inches to 7 inches. All but one of the pallets were four-way entry and this entry ranged from 3½ inches to 6 inches on the width, the 40-inch side, and from 1½ inches to 4 inches on the length, the 48-inch side. Weights ranged from a low of 28 pounds to a high of 61 pounds.

In the food industry the hardwood pallet (Pallet A) is a known quantity. It has been in use since the 1930's and is the backbone of the existing internal handling systems found today. Its strengths (lower cost, easier availability, etc.) and weaknesses (split boards, popped nails, etc.) are known and can be managed. The only advantages offered by any of the pallets tested were the ability to be sanitized, lighter weight, and a potentially longer life. Performance testing (tables 2 and 3) shows no significant advantage of one of these pallets over the standard hardwood pallet. Cost comparisons show the hardwood pallet to be substantially less expensive than the others, although economies of size in plastic pallet manufacturing, if there were a large scale shift to these types, could narrow the price gap considerably.

Of the 11 permanent nonwooden pallets evaluated, only pallets B (molded plastic solid deck) and G (molded plastic heavy grid) were considered physically acceptable for use by the food industry. The others were excluded for a variety of reasons, including: cracked and broken decks and corners from inplant usage; warping of the pallets' decks from age, environment, and usage; and the fact that corners damaged during drop testing could result in damaged cartons and products.

Pallets B and G have disadvantages, however. Once damaged they cannot be as readily repaired at the handling facility as the standard hardwood pallet. The purchase prices of these pallets were 3½ and more than 4½ times that of a hardwood pallet for pallets B and G, respectively. Since these pallets are potentially easier to recycle, subsequent purchase prices may be reduced through trade-in or some other arrangement.

Table 1.—Basic information on the twelve types of permanent pallets tested

Pallet identification			Pallet information				
Pallet	Name[1]	Price[2]	Dimensions L X W X H	Entry clearance Width	Entry clearance Length	Average weight	
		Dollars	*Inches*	*Inches*	*Inches*	*Lbs*	*Oz*
A	Hardwood standard	7.50	48 × 40 × 5-3/16	3-1/2	2-1/2	61	
B	Molded plastic solid deck	35.00	48 × 40 × 5	3-3/4	3	46	12
C	Molded plastic light grid	18.25	48 × 40 × 4-3/4	3-1/2	3-1/2	29	7
D	Molded plastic single face	15.80	48 × 40 × 5	3-5/8	3-5/8	28	
E	Molded plastic double face	23.80	48 × 40 × 5-3/4	3-5/8	3-5/8	44	
F	Molded plastic nine-leg	28.60	48 × 40 × 6-1/4	4-1/2	4-1/2	43	8
G	Molded plastic heavy grid	26.00	48 × 40 × 5	3-1/2	3-1/2	44	
H	Molded plastic foam filled	30.85	48 × 40 × 5-1/4	4	1-1/2	32	4
I	Aluminum I-bean	120.00	48 × 40 × 5	4	2	34	6
J	Aluminum block leg	Exp.[3]	48 × 40 × 7	6	4	41	8
K	Aluminum two-way tube	Exp.[3]	48 × 40 × 6	4	—	49	
L	Aluminum four-way	76.65[4]	48 × 40 × 5-1/2	3-1/2	2-1/2	47	6

[1]Descriptive and not brand names.
[2]In largest order quantity which varied from pallet to pallet.
[3]Experimental.
[4]Plus $250.00 per order set-up fee.

Table 2.—Results of rack storage test of permanent pallets loaded with 2,000 pounds and held for 24 hours

Pallet identification		Pallet deflection[1]		
Pallet	Name	After loading	After 24 hours	After unloading
		Inch	*Inch*	*Inch*
A	Hardwood standard	0.3125	0.3125	0.0625
B	Molded plastic solid deck	.7188	.7500	.3750
C	Molded plastic light grid	.6094	.6406	.4063
D	Molded plastic single face	1.0625	1.4370	.1250
E	Molded plastic double face	.2813	.2813	.0000
F	Molded plastic nine leg	.6563	.6875	.4375
G	Molded plastic heavy grid	.2188	.3750	.1875
H	Molded plastic foam filled	.6563	.6563	.2500
I	Aluminum I-beam	.1250	.1250	.0000
J	Aluminum block leg	1250	1250	.0625
K	Aluminum two-way tube	.2813	.3488	.1250
L	Aluminum four-way	.0625	.0625	.0313

[1]Measured from midpoint.

Table 3.—Results of floor-loaded test of permanent pallets loaded with 2,200 pounds and held for 72 hours

Pallet identification		Deck deflection[1]		
Pallet	Name	After loading	After 24 hours	After unloading
		Inch	*Inch*	*Inch*
A	Hardwood standard	0.0000	0.0000	0.0000
B	Molded plastic solid deck	.0000	.0000	.0000
C	Molded plastic light grid	.0156	.0156	.0156
D	Molded plastic single face	.0000	.0000	.0000
E	Molded plastic double face	1250	1250	.1250
F	Molded plastic nine leg	.2188	.2500	1563
G	Molded plastic heavy grid	.0000	.0000	.0000
H	Molded plastic foam filled	.0625	.0625	.0625
I	Aluminum I-beam	1875	.2813	0000
J	Aluminum block leg	1250	1563	.0000
K	Aluminum two-way tube	.2813	.2813	.1250
L	Aluminum four-way	.0000	.0000	0000

[1]Measured from midpoint.

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